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LEAD PIPE COUPLINGS[1]

By J. A. Jensen

The object of this paper is to discuss the joints commonly used in service pipe connections and the development that has taken place from time to time under the guiding light of experience, for the purpose of improvement and prolonging the life of the service and its various appurtenances.

A service pipe, as discussed here, consists of a corporation cock at the water main, a run of lead pipe to the curb or walk, where a stop cock is placed and covered with a box extending to the surface of the ground, and galvanized iron pipe continued to the premises. Lead pipe is selected because of its durability and necessary physical properties for conditions generally met with in most localities. Galvanized iron pipe is suitable for the remaining portion of the run from the stop cock to the building. The cocks are made of bronze or non-corrodible metal for the purpose of resisting deterioration and, as a consequence, to permit ease of operation.

The principal object in the selection of materials and fittings is to make up a suitable and durable structure that will insure the owner minimum repairs and troubles from leakage. Aside from corrosion of materials, consideration should be given to the various kinds of joints used for connecting the several parts of the service pipe.

The use of lead pipe probably originated the so-called "wiped joint" or soldered connection to the cocks. There were originally in use the fixed soldering nipples. These later gave way, for obvious reasons, to the separate nipples and tail pieces, with their necessary couplings, all of which are now commonly used. For the iron pipe, the common threaded fittings are convenient and apparently suitable for all purposes.

Any improvement in the various parts of a service pipe is naturally based upon the troubles arising from leakage. The leak is the alarm that calls attention to the condition of the service. These leaks require considerable attention by water departments to locate the trouble, to serve notice upon the owner and to see that prompt repairs are made.

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[1] Read before the St. Louis Convention, May 16, 1918.

For some time the City of Minneapolis has given consideration to the matter of service leaks that occur between the water main and the meter. During 1917, there were 642 cases of such trouble which were repaired by licensed plumbers under the supervision of the water department. These leaks not only give trouble and expense to the owner, but also cause a considerable loss of water to the municipality. This loss has been variously estimated at from 15,000,000 to 20,000,000 gallons per year. These services are owned by the consumers but the city supervises their maintenance to prevent loss of water.

The number of leaks referred to is an increase of 19 per cent over the previous year. With an increasing number of services approaching the age of trouble and replacement, further increase in the number of leaks must be expected.

There are no practicable means for the reduction of leaks occurring in existing services, but in order to prolong the life and lessen troubles on services that will be installed in the future, a study was made to discover the precise nature of existing troubles so that the proper remedy could be applied.

At present the service connections are made up of a corporation cock at the main, tail piece with wiped joint to lead pipe leading to the stop cock at the curb where it is again wiped to a soldering nipple. From this point to the meter, galvanized iron pipe is used. All of the wiped joints are made by licensed plumbers who install all services under city inspection.

A classification of service leaks was made and some interesting data have been obtained which indicate clearly the various kinds of trouble encountered. The classification was as follows:

1.	Defective curb cock	6	1.0 per cent.
2.	Iron pipe, corroded	302	47.0 per cent.
3.	Lead pipe, corroded or burst	96	15.0 per cent.
4.	Wiped lead joints	238	37.0 per cent.
	Total	642	100.0 per cent.

In considering only the serious leaks in this table, those that occur in iron pipe might be set aside, since such pipes are accessible for repairs without disturbing walks or pavements to any serious extent. The portion of the service that should be most secure and durable is the lead pipe and its connections which are located under the roadway and in the majority of cases under pavements.

The street leaks may then be separated and reclassified as follows:

1.	Defective curb cock	6	2.0 per cent.
2.	Lead pipe, corroded or burst	96	28.0 per cent.
3.	Wiped lead joints	238	70.0 per cent.
	Total	340	100.0 per cent.

An examination of these street leaks shows the following facts to be apparent:

1. The curb cocks enumerated were found to be defective. They were all old-style cocks which have since been replaced by an improved type by the use of which a minimum amount of trouble will be experienced in the future.

2. The table shows 28 per cent of street leaks to be in the lead pipe itself. About one-sixth of these were due to bursts by swelling of the pipe from repeated water hammer caused by defective faucets. Inspection of these showed all such pipe to be of lighter weight than that used at present. One-fourth of the lead pipe troubles were found under car tracks and the pitting and corrosion clearly indicate electrolysis. The remaining leaks were due to other causes, though many of them also appear to be from the effects of electrolytic action. Since heavy lead pipe is now used and means are employed to eliminate electrolysis, these troubles are already reduced to a minimum, so far as the future is concerned, and justification found for the continued use of lead pipe.

3. The wiped joint leaks make up 70 per cent of the street leaks and troubles. These leaks are due chiefly to inferior workmanship. In most cases there has been failure to secure proper bonding in the joint. A number were "lop-sided;" others barely covered the end of the tail piece and in several cases the solder had run inside and partially closed the water opening. One joint had an opening left no larger than a pencil and after a remarkable record of patience covering a period of 24 years, the owner had the service dug up and the trouble was discovered and corrected. Many of these joints stood up for many years before giving way.

Several years ago lead pipe was used extensively in all plumbing work, but at the present day it has been replaced almost entirely by improved plumbing appliances and fittings made of other materials than lead, so that the art of wiping lead joints has passed into the hands of pipe fitters rather than the plumbers of former days. In many shops the wiped joints on service pipes form the only work of this nature that is encountered, and it must be undertaken as a special task. The work is attempted by unqualified and incompetent persons not familiar with nor skilled in the art. The result is that present-day wiped joints, under these conditions, do not measure up to the standard of former times, and more trouble may be expected in the future than in the past if such joints continue to be installed.

It appears from a consideration of this matter that these facts have been recognized in various cities. Efforts to secure protection against inferior joints have resulted in the development of a connection that is superior to the wiped joint.

This joint is a mechanical connection in the form of a coupling in which the lead pipe is shaped to form its own gasket. The lead flange should undergo slight reaming to make true parallel surfaces for close contact. The couplings should have plane faces, at least in part, to insure a good joint and must not be permitted to cut the lead flange. The coupling should have a sleeve to cover a short portion of the lead pipe close up to the flange to prevent any movement or deformation of the lead at the joint. The shaping of the lead flange may be conical or at right angles to the axis of the pipe.

There are several types of this joint on the market, all having desirable features of design, but the principle is similar in all cases. The coupling is made a part of the corporation or curb cock and is of composition metal. The joint develops the full strength of the lead pipe and is equally as strong as the best wiped joint and superior to it in results because it can eliminate defective workmanship.

Tests made in the presence of waterworks men have demonstrated conclusively that rupturing stresses applied as internal pressures and tension on lead pipe secured at both ends by flanged curb cocks, have failed to break the joint or injure the coupling. In all cases the lead pipe burst or parted.

The initial cost of the material for this joint is slightly greater than for the wiped joint, but when the necessary labor is added, this cost is more than offset. The cost to the property owner ought at least to be practically the same. An intelligent man can make a flange coupling joint with simple tools and a pair of wrenches in a very short time, and on the ground where required. The need of a plumber with a blow-pot and other appliances is eliminated.

The comparative cost of the wiped joints and flange couplings in an ordinary service, at recent prices and labor costs, is as follows:

⅝-inch wiped joint corporation cock	$1.05
¾ inch wiped joint curb cock	2.40
2 pounds solder, two wiped joints	.80
Plumber's time, 1 hour	.90
Total cost wiped joints	$5.15
⅝-inch flange coupling corporation cock	$1.30
¾-inch flange coupling curb cock	3.15
Time making joints, 1 hour	.40
Total cost flange joints	4.85

This shows a balance of $0.30 on each service in favor of the flanged joints which can be considered as a margin for fluctuation in cost of materials and labor.

In considering the data given, the use of lead flange joints promises longer life to service connections as a whole, and a consequent reduction of leakage troubles and expense to both the city and property owner.

The street service department of Minneapolis has used lead flange couplings of different types for repair work for several years and they have been satisfactory and successful in every way. They have not only proved more convenient than the wiped joint for the department, but their use has also resulted in the saving of time and money in every case.